Appendix SA2: The Impact of Policy Incentives on Long-Term Care Insurance andMedicaid Costs: Does Underwriting Matter? .

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1 Policy variables

Table A.1 shows the policies examined in this paper and their implementation dates, including state Partnership programs, tax deductions, and tax credits.

Exhibit A.1: State policy implementation of long-term care insurance incentives

State	Partnership effective date	Unique State Deduction	Unique State Credit	Federal itemized deductions	Tax benefit year started	Tax details
AL	3/1/2009	X			1995	Deduction Individuals are allowed an itemized deduction for qualified long term care insurance contract to the extent that the amount does not exceed specified limitations. These amounts are indexed. Businesses, whether incorporated or not, may deduct LTC insurance as reasonable compensation expenses.
AK	Not Filed					No tax benefits presently.
AZ	7/1/2008					No tax benefits presently
AS	7/1/2008			X	1997	Deduction A deduction is allowed to the limits provided in the federal Internal Revenue Code (see above for details)
CA	Original Partnership			X	2003	Deduction A deduction is allowed to the limits provided in the federal Internal Revenue Code (see above for details)
CO	1/1/2008		X	X	2000	Credit A Credit is allowed for 25 percent of the premiums paid for long term care insurance during tax year for the individual and spouse. The Colorado credit is only applicable to thoise with federal taxable income of less than $50,000; to two individuals filing a joint return with a federal taxable income of less than $50,000 if claiming the credit for one policy; or less than $100,000 if claiming the credit for two policies.

Exhibit A.1 Continued: State LTCI Policies

State	Partnership effective date	Unique State Deduction	Unique State Credit	Federal itemized deductions	Tax benefit year started	Tax details
CT	Original Partnership					No tax benefits presently
DE	11/1/2011					No tax benefits presently
DC	Not Filed	X			2005	Deduction A deduction for long term care insurance premiums paid annually is allowed from gross income provided that the deduction does not exceed $500 per year, per individual. It does not matter whether the individual files joiuntly and the LTC poilicy must meet District of Columbia's definitions.
FL	1/1/2007					No tax benefits presently
GA	1/1/2007					No tax benefits presently
HI	Pending			X	1999	Deduction Same as federal tax law, except subject to 7.5% of HI adjusted gross income, instead of federal adjusted gross income.
ID	11/1/2006	X			2003	Deduction A deduction is allowed for premium paid by a taxpayer for LTCi which is for the benefit of the taxpayer, a dependent of the taxpayer or an employee of a taxpayer and the amount can be deducted from taxable income to the extent the premium is not otherwise deducted by taxpayer.
IL	Pending					No tax benefits presently
IN	Original Partnership	X			2000	Deduction Deduction up to full cost of premium paid for qualified LTCi for taxpayer and taxpayer's spouse paid in the taxable year.

Exhibit A.1 Continued: State LTCI Policies

State	Partnership effective date	Unique State Deduction	Unique State Credit	Federal itemized deductions	Tax benefit year started	Tax details
IA	1/1/2010			X	1997	Deduction A deduction is allowed to the limits provided in the federal Internal Revenue Code (see above for details)
KS	4/1/2007	X			2003	Deduction For tax years beginning in 2005,a subtraction from federal adjusted gross income for $500 in the tax year 2005, increasing each year by $100 until 2010. After 2010, it is a $1000 subtraction from the federal adjusted gross income for premium costs for qualified LTCi.
KY	6/16/2008	X			1998	Deduction Deduction from adjusted gross income allowed for any amount paid during the tax year for LTC premiums.
LA	10/1/2009		X		2002	Credit A credit against the individual income tax is allowed for amounts paid as premiums for eligible long term care insurance. The amount of the credit equals 10 percent of the total amount of premiums paid each year by each individual claiming the tax credit and the policy must meet the specific qualification requirements.

Exhibit A.1 Continued: State LTCI Policies

State	Partnership effective date	Unique State Deduction	Unique State Credit	Federal itemized deductions	Tax benefit year started	Tax details
ME	7/1/2009	X			1990	Deduction The Superintendent of the State must certify the policy you purchase as a qualifying long term care policy. Then you are pemitted a deduction as long as the amount subtracted is reduced by the amount claimed as a deduction for federal income tax purposes. Sounds more complicated than it really is. Employers providing long term care benefits to employees may also qualify for a tax credit which follows a formula equal to the lowest of $5,000, 20 percent of the costs or $100 for each employee covered.
MD	1/1/2009		X		2000	Credit Taxpayer is allowed a one-time credit against the state income tax in an amount equal to 100% of eligible LTCi premium paid. The credit may not exceed $500 for each insured, may not be claimed by more than one taxpayer with respect to the same individual and may not be claimed if the insured was covered by LTCi before July 1 2000. No carryover is allowed. For employers, a credit up to an amount equal to 5% of the costs incurred by the employer during the taxable year for providing LTCi as part of the benefit package. The credit may not exceed $5000 or $100 for each employee covered by LTCi under the benefit package.
MA	Proposed					No tax benefits presently

Exhibit A.1 Continued: State LTCI Policies

State	Partnership effective date	Unique State Deduction	Unique State Credit	Federal itemized deductions	Tax benefit year started	Tax details
MI	Work stopped					No tax benefits presently
MN	7/1/2006		X		2000	Credit A credit is allowed for LTCi premiums equal to the lesser of: (1) 25% of premiums paid to the extent not deducted in determining federal taxable income; or (2) $100 (which equals $200 for married couples who file joint tax returns.)
MS	Not Filed		X		2007	Credit A credit equal to 25% of premium costs paid during the taxable year for a qualified policy for self, spouse, parent, parent-in-law, or dependent. The credit cannot exceed $500.
MI	8/1/2008	X			2007	Deduction Taxpayers may deduct 100% of all non-reimbursed amounts paid for qualified LTCi premiums to the extent such amounts are not included in itemized deductions.
MT	7/1/2009	X	X		1997	Deduction - Credit Montana offers both a deduction for entire amount of qualified LTCi premiums covering taxpayer, taxpayer's parents, grandparents & dependents. A tax credit is now allowed for for premiums paid for long term care insurance coverage for a qualifying family member. The amount of the credit shall be based on the taxpayer's adjusted gross income and can not exceed $5,000 per qualifying family member in a taxable year. Or, $10,000 for two or more family members.

Exhibit A.1 Continued: State LTCI Policies

State	Partnership effective date	Unique State Deduction	Unique State Credit	Federal itemized deductions	Tax benefit year started	Tax details
NE	7/1/2006	X			2006	Deduction Nevada now permits a tax deduction for Long Term Care Savings Plan contributions of up to $2,000 per married filing jointly return or $1,000 for any otrher return to the extent that it is not deducted for federal income tax purposes.
NV	1/1/2007					No tax benefits presently
NH	2/16/2010					No tax benefits presently
NJ	7/1/2008	X			1997	Deduction Deduction of LTC insurance premiums may be taken if they exceed 2% of adjusted gross income and cannot be reimbursed.
NM	Not Filed	X			2000	Credit / Deduction. New Mexico permits taxpayers who are age 65 and older and who are not a dependent of another taxpayer to claim a credit of $2,800 for medical care expenses which includes long term care insurance premiums paid for the filing taxpayer, spouse or dependents if expenses equal $28,000 or more within the particular taxable yeare (and so long as the expenses are nopt reimbursed). A deduction allows taxpayers an additional exemption of $3,000 for medical expenses if expenses (including the cost for LTC insurance) equal $28,000 or more within the taxable year and if expenses are not reimbursed or otherwise covered.

Exhibit A.1 Continued: State LTCI Policies

State	Partnership effective date	Unique State Deduction	Unique State Credit	Federal itemized deductions	Tax benefit year started	Tax details
NY	Original Partnership	X	X		1996	Credit Credit for 20% of premium paid for qualifying LTCi premiums. Taxpayer is permitted to carry over to future tax years any credit amount in excess of taxpayer's tax liability for the year. Employers are eligible for a credit equal to 20% of the premiums paid during the tax year for the purchase of, or for continuing coverage under, a LTCi policy. The credit is not refundable and the credit may not reduce the tax to less than the minimum tax due. NY provided a tax deduction from LTCI premiums from 1996 through 2001, and a credit from 2002 onwards. It was doubled from 10% in 2002 to 20% in 2004.
NC	3/7/2011		X		1999	Credit A credit is allowed for premiums paid on LTC insurance for taxpayer, taxpayer's spouse or dependent in an amount equal to 15% of the premium costs, up to $350 for each policy on which the credit is claimed as long as adj. gross income meets the following limitations: Married Filing Separately ¡$50,000; Single ¡$60,000; Head of Household ¡$80,000; Married Filing Jointly or Qualifying Widower ¡$100,000.

Exhibit A.1 Continued: State LTCI Policies

State	Partnership effective date	Unique State Deduction	Unique State Credit	Federal itemized deductions	Tax benefit year started	Tax details
ND	1/1/2007		X		1994 - 2009	Credit A credit is allowed for premiums paid on LTC insurance for taxpayer and or spouse up to $250 within any taxable year. "Utah and North Dakota have recently eliminated their tax incentives for long-term care insurance, Utah for tax year 2008 and North Dakota for tax year 2009."
OH	9/10/2007	X			1999	Deduction Deduction of federally qualified LTCi premiums for taxpayer, taxpayer's spouse and dependents to the extent deduction is not allowed in computing federal adj.gross income.
OK	7/1/2008					No tax benefits presently
OR	1/1/2008		X		2000	Credit Credit equal to the lesser of 15% of premiums paid during the tax year or $500 for LTC insurance coverage for individual, dependent or parents. For employers, a credit of $500 is allowed for each employee covered by an employer-sponsored policy.
PA	9/15/2007					No tax benefits presently
RI	7/1/2008					No tax benefits presently
SC	1/1/2009					No tax benefits presently
SD	7/1/2007					No tax benefits presently
TN	10/1/2008					No tax benefits presently
TX	3/1/2008					No tax benefits presently

Exhibit A.1 Continued: State LTCI Policies

State	Partnership effective date	Unique State Deduction	Unique State Credit	Federal itemized deductions	Tax benefit year started	Tax details
UT	Not Filed				2000 - 2008	No tax benefits presently. "Utah and North Dakota have recently eliminated their tax incentives for long-term care insurance, Utah for tax year 2008 and North Dakota for tax year 2009."
VT	Not Filed					No tax benefits presently
VA	9/1/2007		X		2000	Deduction Virginia statutes permit a deduction from federal adjusted gross income for the amount paid in long term care insurance premiums provided the individual has not claimed a deduc tion for federal tax puposes or a credit under Virginia tax code 58.1-339.11. This code permits a credit against the individual's income taxes that shall not exceed 15 percent of the amount of long term care insurance premium paid during the taxable year. And, the credit can not be claimed to the extent that the individual has claimed a deduction for federal tax purposes. This one is worth having your CPA decide as a tax credit can be worth far more than a tax deduction.
WA	1/1/2012					No tax benefits presently
WV	17/01/2010				2000	Deduction Deduction for LTCi premiums covering taxpayer, taxpayer's spouse, parents and dependents to the extent the amount paid for LTCi is not deducted in determining federal income tax.

Exhibit A.1 Continued: State LTCI Policies

State	Partnership effective date	Unique State Deduction	Unique State Credit	Federal itemized deductions	Tax benefit year started	Tax details
WI	1/1/2009				1998	Deduction Deduction allowed for taxpayer & taxpayer's spouse for 100% of the amount paid for a LTCi policy to the extent the same deduction is not taken for federal income tax purposes.
WY	6/29/2009					No tax benefits presently

2 Underwriting Process

Because the application process is time-consuming and costly, agents typically do not market long-term care insurance to prospective buyers over the age of 70, where underwriting rejection rates can be high, and steer those who already exhibit some other easily determined disqualifying condition away from the process. For example, in a guide for insurance agents developed by one of the largest carriers of long-term care insurance, agents are instructed to discourage applications from individuals who are morbidly obese or who have been diagnosed with one of a list of conditions such as multiple sclerosis, Alzheimer's disease, cirrhosis of the liver, or Parkinson's disease,[1] conditions that would put the individual at high risk for immediate need of long-term care services. Most state regulations require agents to verify that their clients' income and assets meet minimum thresholds for the premiums to be financially suitable. As part of the initial meeting, carriers in these states (and most carriers even in states where it is not required by law) have their agents counsel clients—usually in the form of a personal worksheet—as to whether their assets and income are sufficient for long-term care insurance to be a suitable financial product for them. The rule of thumb proposed by the National Association of Insurance Commissioners (NAIC) is that that if the client is currently eligible for Medicaid or has less than $30,000 in assets, or if the premium amount would be more than 7% of their income, then long-term care insurance may not be appropriate.[2]

Underwriting accuracy confers a competitive advantage in the marketplace, and standards and protocols vary across companies and are protected as confidential company assets. These screens can include comprehensive screening of mobility, activities of daily living (ADLs) and instrumental activities of daily living (IADLs), cognitive screening, medical history, living environment and clinical observations. At the beginning of the long-term care insurance purchasing process, selling agents discourage applications from buyers who have easily determined disqualifying conditions or have insufficient income or assets for premiums to be financially suitable. For individuals who submit formal applications, the underwriting assessment starts with a health history questionnaire. To verify applicants' information and collect more detailed information, insurers may request medical records or conduct telephone interviews or home visits. For qualifying applicants, firms offer a premium rate and coverage terms for consideration. Firms tend to offer age- and (more recently) gender-rated standard premium rates. Health is taken into account in deciding whether to offer coverage at all, and in some cases whether to provide a discount or added premium to a base premium rate.

After a reviewer with clinical training examines the applicant's file and makes a coverage

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[1]Genworth Life Insurance Company [Internet]. TrueView Underwriting Guide. Richmond, VA; 2013 Mar 15 [cited 2015 December 10]. Available from: `http://www.ltcforagents.com/carriers/genworth/Underwriting_Guides/Genworth_Underwriting_Guide_52013.pdf`

[2]Long-term Care Insurance Model Regulation. National Association of Insurance Commissioners. Model regulation service; 2014 Oct [cited 2015 July 29]. Available from: `http://www.naic.org/prod_serv_model_laws.htm`

recommendation, the applicant receives an offer of coverage with premium amounts and makes a decision to purchase. Firms tend to offer age- and (more recently) gender-rated standard premium rates, taking health into account only in deciding whether to accept or decline an applicant; they generally do not consider it in setting premiums for those they accept. When health is taken into consideration, some firms may offer discounts for being in a preferred risk class—for example, for no use of tobacco, having blood pressure and body weight in the healthy range, and being physically active—whereas the less healthy may be accepted into a substandard risk class at significantly higher premiums. We do not have information on whether the carriers in our study offered differentiated premiums.

3 Insurance Underwriting Data

3.1 Data Collection.

The insurance data were collected by a full service third party administrator (TPA) that made underwriting decisions on behalf of these companies. Insurance firms collected information with written, self-administered questionnaires from applicants and sent them to the TPA where a clinician reviewed each applicant's file and offered a recommendation to "approve" or "not approve" the application. Although the applicants' answers were not independently verified, the insurer's right to rescind a policy based on fraud or material misrepresentation (generally only within the first two years after policy issue) gives applicants the incentive to report their health status in good faith. We use a sub-set of the characteristics that correspond to items in the Health and Retirement Study (HRS). Some reported health conditions are aggregated categories from several diagnoses or self-reported conditions (see Exhibit **??**). Although employment and education may not be explicitly considered in underwriters' decisions, we nonetheless include these covariates because they can capture some aspects of health and functional status otherwise not measured in the HRS.

3.2 Underwriting Analysis

To estimate underwriting approval probabilities for the general population, we developed an empirical model of the coverage decision using underwriting data from the long-term care-insurance carriers and applied the model parameters to a nationally representative sample of older US residents. We report a linear probability model of underwriting approval, estimated using ordinary least squares, to facilitate an intuitive interpretation of the percentage-point effect on probability of approval of each characteristic and health condition. The model is as follows:

$Y_i = X_i\beta + \epsilon_i$

Where Y is 1 for approved and 0 for disqualified applicants, and X is the vector of applicant characteristics (age categories, health conditions, etc.), and ϵ is a randomly distributed error term.

Those results, with standard errors, are displayed in Column 1 of Exhibit **??** with standard errors, and correspond to Exhibit 1 of the main article.

We estimated the probability of underwriting approval using the generalized linear model:

$Pr(Y_i = 1) = F(X_i \beta^*)$

Where F is the logistic function. Results with 95% confidence intervals are shown in Exhibit A.2. Column 2 of Exhibit **??** shows the population-averaged marginal effects of X (using the Stata *margeff* command), with standard errors calculated using the delta method, where each estimate is the difference in approval rate for the entire sample between $X_{i,k} = 0$ and $X_{i,k} = 1$. These are similar to the OLS estimates.

To estimate individual probabilities we specified a model with indicators for each age-year value, interaction terms of gender with age, and a variable for the number of health conditions (1, 2, and 3 or more), as reported in Exhibit A.2, column 2. For each individual in the HRS sample, we calculate $\hat{p} = F(X_i^{HRS} \beta^*)$ for each respondent in the HRS sample to predict the probability they would be offered a policy, supposing they were to apply for insurance subject to similar underwriting conditions.

To summarize the results, for each sub-sample s we report both the mean of the predicted probabilities ($\bar{\hat{p}}^s$), and the percent of the sample that is likely approved ($\hat{\pi}^s_{appr}$), where:

$\bar{\hat{p}}^s = \frac{1}{n} \sum_{i=1}^{n} \hat{p}^s$

$\hat{\pi}^s_{appr} = \frac{1}{n} \sum_{i=1}^{n} I(\hat{p}^s >= 0.5)$

We generated the approval probability models with Stata version 13 and estimated survey statistics and generated figures with R version 3.1.3.

Exhibit A.2: Models to estimate marginal effects and predict underwriting probabilities

	(1)	(2)
Age 50 - 59	0.901	
	[0.793,1.022]	
Age 60-69	0.743***	
	[0.648,0.852]	
Age 70+	0.613***	
	[0.479,0.783]	
Female	1.110**	0.931
	[1.013,1.216]	[0.751,1.154]
Education 16+ years	1.147***	1.156***
	[1.052,1.249]	[1.060,1.260]
Employed	1.213***	1.164***
	[1.097,1.341]	[1.050,1.291]
Word recall score < 7	0.795***	0.801***
	[0.723,0.873]	[0.728,0.880]
Self-reported memory loss	0.890**	0.880**
	[0.801,0.989]	[0.792,0.979]
Difficulty taking medication	0.609**	0.638**
	[0.413,0.899]	[0.432,0.941]
Difficulty with 1+ ADL	0.060***	0.054***
	[0.016,0.226]	[0.014,0.209]
High blood pressure	0.611***	0.745***
	[0.559,0.668]	[0.605,0.916]
Back pain	0.531***	0.632***
	[0.485,0.581]	[0.514,0.777]
Arthritis	0.548***	0.597***
	[0.491,0.613]	[0.484,0.736]
Diabetes	0.125***	0.143***
	[0.107,0.145]	[0.113,0.181]
Heart problems	0.483***	0.549***
	[0.429,0.544]	[0.443,0.679]
Psychiatric illness	0.478***	0.545***
	[0.425,0.538]	[0.439,0.675]
Lung problems	0.610***	0.664***
	[0.523,0.711]	[0.528,0.835]
Cancer	0.530***	0.618***
	[0.433,0.648]	[0.473,0.808]
Stroke	0.047***	0.053***
	[0.022,0.102]	[0.024,0.115]
Hospitalization, prev 2 years	0.643***	0.653***
	[0.590,0.701]	[0.599,0.712]

Exhibit A.2: Models to estimate marginal effects and predict underwriting probabilities

	(1)	(2)
Long-term care, prev 2 years	0.705	0.675*
	[0.457,1.090]	[0.439,1.039]
Drinks alcohol	1.177**	1.164**
	[1.023,1.355]	[1.011,1.341]
Ever been a smoker	0.908**	0.930
	[0.826,0.997]	[0.846,1.023]
Current smoker	0.483***	0.481***
	[0.411,0.568]	[0.408,0.567]
Underweight	0.329***	0.312***
	[0.198,0.544]	[0.185,0.526]
Obese	0.740***	0.732***
	[0.675,0.811]	[0.668,0.803]
Extremely Obese	0.232***	0.228***
	[0.160,0.336]	[0.157,0.331]
1 health condition		0.539***
		[0.430,0.677]
2 health conditions		0.473***
		[0.318,0.704]
3 health conditions		0.575*
		[0.307,1.079]
Constant	10.563***	15.863***
	[8.522,13.093]	[12.370,20.341]
Observations	15659	15659
Pseudo R-squared	0.19	0.20
Akaike's Inf. Crit.	14113	14036
Bayesian Inf. Crit.	14328	14587
Log-likelihood	-7029	-6946

Source: Authors' analysis of the Health and Retirement Study.

Notes: We modeled probability of approval in a multivariate logistic regression. Exponentiated odds ratios are shown with 95% confidence intervals in brackets. Model 1 is the specification for marginal effects reported in Table **??**. Model 2 is used to impute probabilities in the HRS sample, and includes fixed effects for each year of age, and age-female interactions (coefficients not shown). The reference category for age and age-female interactions is the $18-49$ age group. $*p < .05, **p < .01, ***p < .001$

Exhibit A.3: Prevalence of long-term care insurance by approval quartile

	Tax incentive sample		Partnership sample	
Underwriting approval quartile	Approval probability	Has long-term care insurance	Approval probability	Has long-term care insurance
ltc_quart_1				
mean	0.048	0.065	0.048	0.075
sd	0.044	0.25	0.045	0.26
min	0.0000075	0	0.0000075	0
max	0.15	1	0.15	1
count	10746	10746	8752	8752
ltc_quart_2				
mean	0.37	0.097	0.37	0.10
sd	0.11	0.30	0.11	0.31
min	0.15	0	0.15	0
max	0.54	1	0.54	1
count	11884	11884	9615	9615
ltc_quart_3				
mean	0.67	0.11	0.67	0.12
sd	0.064	0.31	0.064	0.33
min	0.54	0	0.54	0
max	0.77	1	0.77	1
count	14481	14481	10499	10499
ltc_quart_4				
mean	0.87	0.12	0.87	0.13
sd	0.057	0.32	0.057	0.33
min	0.77	0	0.77	0
max	0.97	1	0.97	1
count	16392	16392	11367	11367
Years	1996-2006		2002 - 2012	

4   Additional summary statistics

Table A.3 shows the summary statistics for approval probability and holding long-term care insurance policies, by quartile, for the samples used in the tax incentive and Partnership analyses. (Note that quartiles were calculated for the entire available HRS sample, 1996 - 2012, and are consistent between the two sets of analyses, which is why the quartiles do not contain equal numbers of observations.) The mean prevalence of insurance increases with imputed-approval quartile, from 6.5% to 12% for the tax sample, and from 7.5% to 13% for the Partnership sample.

Table A.4 shows the distribution of assets holdings as measured in the HRS within groups used in the Partnership models. Amounts are reported in thousands of 2013

Exhibit A.4: Description of assets by group

Summary of total assets by asset group			
	Low	Medium	High
Asset percentile	0-50%	50-80%	80-100%
Mea n	48.0	340.5	1720.1
SD	(80.4)	(119.5)	(2491.8)
Min	-2769	172	588
Max	171	588	117399
Observations	29411	16657	11950

U.S. dollars using the consumer price index. Low, medium and high asset groups were assigned by first multiplying the total assets reported in the Health and Retirement Study by the consumer price index for the interview year and then decile cut-off points were determined for the entire HRS sample.

5 Analysis of the effect of tax price

5.1 Calculation of insurance price after tax subsidies

One of the policy changes examined in this paper is the implementation of state tax deductions and credits for long-term care insurance premiums. The effect that these changes to the tax code have on the observed price for an individual or family, however, depend on their tax liability and marginal tax rates, so I examine both the binary effect of having any tax benefit, and a measure the price of $1 of long-term care insurance after tax deductions and credits have been accounted for (the after-tax price). I calculate marginal tax rates are calculated for Health and Retirement Study (HRS) respondents by running the respondents' income and demographic information through the National Bureau of Economic Research (NBER) TaxSim calculator (Feenberg and Coutts 1993). The variable inputs are shown in table A.5.

5.2 Instrumental variable analysis

Ordinary least squares (OLS) model to estimate the effect of tax benefits on LTCI is likely to be biased and inconsistent. Income, and therefore the marginal tax rate, is correlated with demand for long-term care insurance in ways we cannot observe in the HRS data or control for in the OLS equation. Further muddying the waters, income is also related to health status and therefore underwriting probabilities. Following the strategy used by Goda (2011), I instrument for the after-tax price experienced by the

Exhibit A.5: Variable inputs for TAXSIM

TAXSIM input	Description	HRS database	variable(s) used
pwages	Income of primary taxpayers	RAND	r#iearn
swages	Income of secondary taxpayer	RAND	s#iearn
dividends	Dividend income	RAND income and wealth files	hidivin
otherprop	Interest and other property income	RAND	h#iother
pensions	Taxable pension income	RAND	r#ipena + s#ipena
gssi	Gross social security benefits	RAND	r#isret + s#isret
transfers	Non-taxable transfer income	RAND	r#igxfr
rentpaid	Rent paid	RAND fatfiles	h079-h083
proptax	Property tax paid	RAND fatfiles	h075-h077, h186, h187
otheritem	Other itemized deductions	RAND fatfiles	q449-451 (medical), q454-456 (charity)
childcare	Child care expenses	imputed as 0	
ui	Unemployment compensation benefits	RAND	r#iunwc
mortgage	Mortgage interest paid	RAND	h#amort * 0.06
stcg	Short-term capital gain/loss	RAND	h#icap - hidivin
ltcg	Long-term capital gain/loss	imputed as 0	

respondent with a simulated average price for a nationally representative cohort (the full HRS sample in that year) subject to that state's tax laws.

5.3 Two-stage least squares estimate

We are interested in the causal relationship between prices and insurance update, as mediated by underwriting score. The structural equation to describe that relationship is as follows: $LTCI_{ist} = \alpha X_i + \gamma PRICE_{ist} \times UNDERWRITING_{ist} + UNDERWRITING + \omega_t + \sigma_s + \epsilon_{ist}$

where γ is the causal effect of price changes on long-term care insurance purchase. But since, in this case, tax price is endogenous to income, we start from the reduced-form and first-stage equations:

[1] $PRICE_i st = \beta_{01} X_i + \pi_1 SIMPRICE + \xi_{1ist}$

[2] $LTCI_{ist} = \beta_{02} X_i + \pi_2 SIMPRICE + \xi_{2ist}$

In [2], the parameter π_1 captures the first-stage effect of simulated tax price on the individual's observed after-tax price, after controlling for X_i. The parameter π_2 captures the reduced-form effect of simulated tax price on insurance purchase, also sometimes called the "intent to treat" effect. The covariate-adjusted IV estimator is the sample analog of the ratio $\frac{\pi_2}{\pi_1}$. Substituting the first-stage equation into the causal (structural) equation gives the two-stage estimate of γ: $LTCI_{ist} = \alpha X_i + \gamma[\beta_{01} X_i + \pi_1 SIMPRICE] + \xi_{2ist}$

In a random sample, the first-stage values are fitted by:

$\widehat{PRICE}_{ist} = \hat{\beta}_{01} X_i + \hat{\pi}_1 SIMPRICE$

where β_{01} and π_1 are OLS estimates from equation [1].

The two-stage least squares (2SLS) estimate of γ can be constructed by estimating the coefficient on $\hat{s}_i$ in the regression of $LTCI_i$ on X_i and $\widehat{PRICE}_{ist}$.

$LTCI_{ist} = \alpha X_i + \gamma \hat{s}_i + [\eta_i + \gamma(s_i - \hat{s}_i)]$

5.4 Verifying IV assumptions

Several assumptions that form the basis for the IV framework should be verified or indirectly tested in order to make a candidate instrument a plausibly valid one. They include:

Instrument relevance: The instrument, simulated tax price, should explain variation in the premium price that households experience.

Exhibit A.6: First-stage instrument strength

	(1) State FE	(2) Person FE
Simulated tax price	1.464***	1.126***
	(49.85)	(59.77)
N	53503	53503
N_g	51	16080
r2_a	0.315	0.275

F statistic for the instrument is shown in parentheses. Models regress the respondent's observed after-tax pricefor long-term care insurance premiums on the instrument, which is the state-average after-tax price for a nationally representative cohort in that year. State fixed effects and state-year time trend included in both models; model (2) includes individual fixed effects. Controls include gender, age, marital status, education, number of children, race (black, white, other), Hispanic ethnicity, retirement status, self-reported health status, state nursing-home occupancy, nursing home beds per person over age 66, and proportion of the state population over age 65.

This is testable in the data by looking at the strength and precision of estimate for the coefficient $\hat{\pi}_1$ on $SIMPRICE$ in equation [1]. When the instrument is weak, even small biases that result from any violation of the assumptions that follow are magnified. Table A.6, shows the regression of observed after-tax price on simulated tax price. The F statistic for the coefficient on the instrument for both the state- and individual-fixed-effects models, exceeds the suggested critical value of 10 for a single instrument (Staiger and Stock 1997).

Independence: We assume that the instrument is as good as randomly assigned, conditional on the values of the observed X covariates. In this analysis, it is the assumption that controlling for observed covariates and year- and individual-fixed-effects, the introduction of a tax subsidy is independent of other factors that influence a household's decision to purchase long-term care insurance. This assumption might be violated if, for example, changes to the tax benefits for long-term care insurance are in response to shocks to the robustness of regional insurance markets that affect prices (since in this analysis, the year-to-year changes in premium price are presumed to be consistent across regional markets).

Exclusion restriction: Simulated tax price affects insurance take-up only through the premium discounts that it creates for households, and not through any other channel. An example of a violation of this assumption would occur if policy changes instigated a marketing campaign by insurance companies in that state. While still a downstream effect of the policy in a general sense, extra efforts on the part of insurance companies would not be strictly interpretable as a price elasticity.

Table A.7 shows the standardized differences in means of the covariates, splitting the sample at the fiftieth percentile. In Column 1 the sample is split by the observed tax price, and in Column 2 the sample is split by the instrument, state-averaged tax price. Column 3 is the ratio of the S.D.'s of the IV to observed tax price. Mahalanobis Distance, in the final row, is a summary measure of covariate distance. Covariate balance is improved on all covariates except race. That suggests there is a strong correlation between race and state implementation of tax subsidies. While race is included as a control variable, that imbalance suggests the possibility that other important characteristics that are unobserved may also be correlated with state policies and with long-term care insurance. However, since the preferred model specification includes fixed effects for state and, in the preferred model, individual fixed effects, they are unlikely to create bias in this analysis.

Exhibit A.7: Covariate Balance by Tax Price and Instrument

	TaxPrice	IV	Ratio
Female"	0.03	−0.01	0.33
Married	−0.09	0.04	0.42
Age	1.94	−0.55	0.28
Some_HS	0.13	0.05	0.36
GED	0.01	−0.00	0.62
HS_grad	0.01	−0.02	1.46
Some_college	−0.03	0.00	0.07
College_grad	−0.12	−0.03	0.26
Children	0.34	0.14	0.41
Hispanic	0.06	0.05	0.78
White	−0.00	0.05	11.31
Black	−0.00	−0.05	20.76
Other_race	0.01	−0.00	0.13
Race_missing	0.00	0.00	0.65
Retired	0.17	−0.04	0.22
Health	0.23	0.02	0.07
Income	−36.90	−5.52	0.15
Assets	−167.20	−28.76	0.17
MahalDis	0.40	0.08	0.21

Note: Columns 1 and 2 show standardized differences (S.D.) in means of covariates when the sample is split at the 50th percentile. The final row reports Mahalanobis distance, an overall measure of covariate distance.

6 Calculation of after-tax price

To calculate tax price, each person in the HRS was assigned a premium amount based on their state, year and age. These premiums were calculated from mean annual premiums for policies sold in 2002, from Weiss Ratings, Inc (Johnson et al. 2007, Table V-4). Premiums for ages not reported were interpolated, and assumed to grow by 3% per year. Marginal state tax rates were calculated using the TAXSIM program from the National Bureau of Economic Research (Feenberg 1993, Feenberg and Coutts 1993). The value of the state-year tax credit, tax deduction, or both were calculated according to each individual's marginal state tax rate, up to their state tax liability. The tax price of $1 of long-term care insurance was the proportion of the premium paid after subtracting the value of these credits and deductions. For individuals who did not file a tax return, the amount was set to 1.

Simulated average tax prices were simulated using the full, nationally-representative HRS sample subject to that state and year's tax rules. Because the HRS is a biennial survey in which the bulk of interviews are completed in even-numbered years, average marginal tax rates for odd-numbered years were calculating using the income and tax-filing variables of HRS sample from the wave corresponding to the preceding year.

7 Sensitivity and robustness checks

We executed several sensitivity checks. We did a sensitivity analysis excluding individuals with household assets above $5 million (see A.8 model 3). The coefficients in that model are consistent with the model including the full sample. Contrary to the theoretical prediction, the very-high-asset group seems to be similarly responsive to the Partnership program as the full sample (though with N=421, it is underpowered to find a statistically significant effect). It is possible that the high-asset group finds LTCI attractive as a way to protect those assets.

We also performed sensitivity analyses showing the robustness of our results to inclusion of both policy parameters and to exclusion of the wealthiest households. The correlation between policies is not extreme: most of the implementation of new tax incentives occurred between 1996 – 2004, while the lion's share of Partnership programs were introduced in 2006 – 2012. To check this, we performed a sensitivity analysis to confirm that including both policies created negligible change (less than 1% difference) in our estimates of the key parameters.

Exhibit A.8: Partnership model asset sensitivity checks

	(1)	(2)	(3)	(4)
Partnership	-0.0147	-0.0114	-0.0146	-0.0258
	(0.00781)	(0.00906)	(0.00762)	(0.163)
Partnership × Approval Prob	0.0290*	0.0221	0.0255*	0.0492
	(0.0127)	(0.0132)	(0.0120)	(0.161)
N	48507	37549	48086	421
Assets	Full sample	20%-90%	< \$5 mil	> \$5 mil

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Sensitivity analyses: Effect of presence of a tax incentive on purchase of long-term care insurance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Tax subsidy	0.0273**	0.0190**	0.0190**	0.0193**	0.0180*	0.0138	-0.0129		
	(0.0109)	(0.00754)	(0.00739)	(0.00910)	(0.00948)	(0.0108)	(0.00965)		
Subsidy X Approval probability						0.00919	0.0587**		
						(0.0194)	(0.0232)		
Subsidy X v. low approval								0.0128	-0.000942
								(0.0101)	(0.00924)
Subsidy X low approval								0.0227*	0.00586
								(0.0127)	(0.0107)
Subsidy X high approval								0.0173	0.0285**
								(0.0120)	(0.0123)
Subsidy X v. high approval								0.0211**	0.0362**
								(0.00967)	(0.0151)
Underwriting approval probability						0.00743	-0.00593		
						(0.00715)	(0.0122)		
Low approval								0.00711	0.0177***
								(0.00510)	(0.00625)
High approval								0.00697	0.0131*
								(0.00536)	(0.00757)
V. high approval								0.00344	0.00309
								(0.00556)	(0.00892)
State time trend	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	No	No	No	Yes	Yes	No	Yes	No	Yes
Assets & income	No	No	Yes	No	Yes	Yes	yes	yes	yes
Observations	53503	53503	53503	53503	53503	53503	53503	53503	53503

* p<.1, ** p<.05, *** p<.01.

Notes: Standard errors in parentheses. All models include state and year fixed effects.

Sensitivity analyses: Effect of after-tax price on long-term care insurance: Panel A, state fixed effects

	(1)	(2)	(3)	(4)	(5)
After-tax price $1 LTCI	-0.143***	-0.132***	0.0122	0.0364	
	(0.0400)	(0.0399)	(0.0829)	(0.166)	
State avg after-tax price $1 LTCI					
After-tax price X approval prob			-0.257**	-0.250*	
			(0.104)	(0.151)	
Tax price X v. low approval					0.0630
					(0.182)
Tax price X low approval					-0.0990
					(0.113)
Tax price X high approval					-0.125
					(0.0891)
Tax price X v. high approval					-0.177**
					(0.0734)
Underwriting approval probability			0.278***	0.250*	
			(0.103)	(0.149)	
V. low approval probability					-0.242*
					(0.138)
Low approval probability					-0.0745
					(0.0840)
High approval probability					-0.0489
					(0.0695)
Model	IV	IV	IV	IV	IV
Person_Fixed_Effects	No	No	No	No	No
Assets_Income	No	Yes	No	Yes	Yes
N	53501	53501	53501	53501	53501

Standard errors in parentheses
* p<.1, ** p<.05, *** p<.01.

Sensitivity analyses: Effect of after-tax price on long-term care insurance: Panel B, individual fixed effects

	(1)	(2)	(3)	(4)	(5)
After-tax price $1 LTCI	-0.194*** (0.0498)	-0.187*** (0.0498)	0.0858 (0.0896)	0.0596 (0.102)	
After-tax price X approval prob			-0.457*** (0.128)	-0.421*** (0.132)	
Tax price X v. low approval					0.0210 (0.101)
Tax price X low approval					-0.114 (0.0870)
Tax price X high approval					-0.239*** (0.0719)
Tax price X v. high approval					-0.276*** (0.0755)
Underwriting approval probability			0.457*** (0.127)	0.420*** (0.131)	
V. low approval probability					-0.304*** (0.108)
Low approval probability					-0.152 (0.0990)
High approval probability					-0.0284 (0.0760)
Model	IV	IV	IV	IV	IV
Person_Fixed_Effects	Yes	Yes	Yes	Yes	Yes
Assets_Income	No	Yes	No	Yes	Yes
N	50708	50708	50708	50708	50708

Standard errors in parentheses
* p<.1, ** p<.05, *** p<.01.

Sensitivity analyses: Effect of Partnership on long-term care insurance purchase

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Partnership LTCI Program				0.003	-0.016**		
				(0.006)	(0.007)		
PartnershipXLow Assets	-0.019	-0.014	-0.015**			-0.024***	
	(0.012)	(0.008)	(0.007)			(0.008)	
PartnershipXMed Assets	-0.019*	-0.004	0.002			-0.010	
	(0.010)	(0.008)	(0.007)			(0.007)	
PartnershipXHigh Assets	-0.008	0.028***	0.039***			0.026***	
	(0.017)	(0.008)	(0.008)			(0.007)	
Partnership X Approval Probability (continuous 0-1)					0.035***	0.019*	
					(0.011)	(0.010)	
Partnership X V. low approval							-0.008
							(0.008)
Partnership X Low approval							-0.005
							(0.006)
Partnership X High approval							-0.001
							(0.007)
Partnership X V. high approval							0.018**
							(0.009)
Assets (USD1000)				0.000	0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)	(0.000)
Mid assets	0.032***	-0.002	-0.000	0.008	0.008	0.001	0.008
	(0.008)	(0.007)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)
High assets	0.085***	-0.017*	-0.019**	0.007	0.007	-0.017*	0.007
	(0.011)	(0.009)	(0.009)	(0.007)	(0.007)	(0.009)	(0.007)
Underwriting approval probability				-0.000	-0.018	-0.011	
				(0.009)	(0.012)	(0.011)	
Individual fixed effects	N	Y	Y	Y	Y	Y	Y
Years included	2002-2010	2002-2010	2002-2012	2002 - 2012	2002 - 2012	2002 - 2012	2002 - 2012
Observations	47352	47352	57403	57403	57403	57403	57403

Standard errors in parentheses. * p<.1, ** p<.05, *** p<.01.

8 Medicaid Simulation

8.1 Simulation models

We simulate the impact of providing an incentive in wealth decile i; gender g; and underwriting class u, which we assign to low-risk (high probability of approval) or high-risk (low probability of approval). We show how the results differ from a model where those numbers are held fixed across underwriting types. Coverage rates before and after the policy implementation are $C_i(Ins)$ and $C_i'(Ins) + R_{i,u}$, where $R_{i,u}$ denotes the response to the incentive among individuals with underwriting type u and for wealth decile i. The expected present discounted value (EPDV) of long-term care costs is calculated as:

$$LTC_{u,g} = L\bar{T}C \times \sum_{t=0}^{T-65} \frac{P_{g,u,65+t}(LTC)}{(1+r)^t}$$

where $P_{g,u,65+t}(LTC)$ is is the probability of needing long-term care and r is the discount rate. $M_{i,g}(I)$ and $M_{i,g}(N)$ represent the Medicaid share of EPDV of long-term care expenditures for individuals with and without insurance, respectively. The expected Medicaid share of LTC costs prior to and following tax subsidy, respectively $M_{i,g}(tax)$ and $M_{i,g}'(tax)$, as follows:

$$M_{i,g}(T) = C_i(I) \times M_{i,g}(I) + (1 - C_i(I)) \times M_{i,g}(N)$$

$$M_{i,g}'(T) = C_i'(I)M_{i,g}(I) + (1 - C_i'(I)) \times M_{i,g}(N)$$

The expected Medicaid savings attributed to the tax policy for an individual are:

$$E_{i,g,u}(S_T) = (M)_{(i,g)}(T) - M_{(i,g)}'(T)) \times (LTC)_{u,g}$$

Where $LTC_{u,g}$ is the EPDV of long-term care costs for an individual of gender g and underwriting class u.

The expected cost of implementing a tax subsidy is the foregone tax revenue from individuals getting a deduction or credit for their premium:

$$E_{i,g}(Tax) = S_i \times C_i'(Ins) \times \pi \times \sum_{t=0}^{T-65} \frac{P_{g,u,65_t}'}{(1+r)^t}$$

Where S_i denotes the percentage subsidy offered to wealth decile i, π denotes the annual premium, and r is the time-discount rate. The expression $\sum_{t=0}^{T-65} \frac{P_{g,u,65_t}'}{(1+r)^t}$ denotes the present value of an annual stream of $1 payments that continue for the premium-paying duration valued with interest rate i. $P_{g,u,65_t}'$ represents the probability the policyholder is alive and not on claim at age $65 + t$ and is calculated as follows:

$$P_{g,u,65_t}' = \prod_{65+t=0}^{T-65}(1 - P_{g,65+t}(D) - P_{g,65+t,u}(LTC))$$

Where $P_{g,65+t}(D)$ is the probability of death at age $65 + t$.

The expected savings from implementing a Partnership program issue from the reduction in Medicaid's share of the long-term-care costs of insured individuals who would

not have otherwise bought insurance, while costs are incurred when individuals who would have bought insurance anyway buy Partnership-qualified (PQ) polices, or those who already have insurance convert to Partnership-qualified policies (U.S. Government Accountability Office 2007). Expected Medicaid expenditures for an individual before and after the Partnership program are:

$$M_{i,g}(P) = C_i(I) \times M_{i,g}(I) + (1 - C_i(I)) \times M_{i,g}(N)$$

$$M'_{i,g}(P) = \alpha \times C'_i(I) M_{i,g}(PQ) + (1 - \alpha) \times C'_i(I) M_{i,g}(I) + (1 - C'_i(I)) \times M_{i,g}(N)$$

Where $M_{i,g}(PQ)$ is the Medicaid share of long-term care expenditures for an individual with Partnership-qualified insurance, and α is the proportion of insured individuals who hold Partnership-qualified policies after program implementation. The expected savings (or costs) to Medicaid of implementing a Partnership program are:

$$E_{i,g,u}(S_P) = (M_{i,g}(P) - M'_{i,g}(P)) \times LTC_{u,g}$$

8.2   Simulation inputs

We determined pre-subsidy insurance coverage rates by wealth decile from the HRS. After-tax price of insurance is assumed to be average marginal tax rates by wealth decile, also estimated from the HRS using the NBER TaxSim calculator. Responses to the tax subsidy are estimates from individual fixed-effects models with a linear interaction with underwriting approval, Table 4 Model (4) for the tax incentive, and Table 5 Model (5) for Partnership. In the tax model, estimates of $M_{i,g}(Ins)$ and $M_{i,g}(NoIns)$, Medicaid's share of long-term care expenditures are taken from Brown and Finkelstein (2008). In the Partnership model, Medicaid's shares for individuals with no insurance, traditional insurance, and PQ insurance are taken from Sun and Web (2013), Table 1: No Insurance, Policy 3, and Policy 6, respectively. Mortality rates by age and gender from the Centers for Disease Control (2016). Probabilities of needing long-term care, $P_{g,u,65+t}$ (LTC), for the low-risk group are taken from long-term-care incidence rates among premium-class policy holders compiled by the Society of Actuaries (2016). Monthly cost of a semi-private room in a nursing home is taken from the Genworth Cost of Care Survey (2016). Because there is little in the way of experience studies for the high-risk group (since this risk class is unlikely to buy insurance), we made the assumption that the high-risk group's rate of LTC incidence was approximately threefold that of the low-risk group, based on comparisons of five-year disability incidence rates in the HRS (Cornell et al. 2016, Appendix Exhibit A.10). The proportion of all existing policies α that are Partnership-qualified (including both new and converted policies) was set at 0.8. The average price of a year of nursing-home care was set at \$92,376 for a semi-private room based on the cost-of-care survey by Genworth Financial (2016). The response to the tax is:

$$R_{i,u}(T) = (\hat{\gamma}_1 + \hat{\gamma}_2 U) \times \pi_i$$

Where $\hat{\gamma}_1$ and $\hat{\gamma}_2$ are model estimates taken from Table 4, model (4); U is approval probability; and pi_i is the average after-tax price of \$1 of insurance for an individual of wealth decile i. The response to the Partnership program is calculated as follows:

$R_{i,u}(P) = (\hat{\gamma}'_{1,i} \times I_i + (\hat{\gamma}'_2) \times U$

Where $\hat{\gamma}'_1$ is the estimated coefficient on the interaction term between partnership and asset level in Table 5, Model (6); I_i is an indicator for low, medium, or high assets; and $\hat{\gamma}'_2$ is the coefficient on the interaction of Partnership times approval probability.

Simulation models were created in Excel, which are included in the online supporting information for this article as Appendix SA3.

9 References

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